[C II] 158 μm observations of a sample of late-type galaxies from the Virgo cluster

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We have observed a sample 19 Virgo cluster spiral galaxies with the Long Wavelength Spectrometer (LWS) onboard ESAs Infrared Space Observatory (ISO) obtaining spectra around the [C II] 157.741 micron fine structure line. This line probes both the diffuse components of the Interstellar Medium and the photodissociation regions associated with massive star formation. The 19 galaxies are relatively quiescent in star forming activity compared to the gas-rich and starburst galaxies, considered in previous studies from airborne observatories. They sample RC3 types 0 to 8 and come from both the cluster core and the cluster periphery.

Of the 19 galaxies, 15 were detected in the [CII] line. The range of the [C II] (when detected) to the total Far-IR flux (FIR) (40 - 120 micron, as measured by IRAS) ratio is less than in other surveys, from 0.1% to 0.5%, reflecting the fact these galaxies are relatively quiescent. There is, however, a good correlation between the strength of the [C II] line and the Far-IR flux.

Any influence of the Virgo cluster environment on the [CII] emission was found to be small compared with the strong dependence of the line emission on basic measurables such as morphology or stellar mass. Of interest is the three orders of magnitude difference in the [C II]/K'-band flux ratio and the order of magnitude difference in the [C II]/FIR ratio between RC3 types 0 and 8.

Although statistics are poor and there are large intrinsic line/continuum ratio variations between galaxies, the data show an overall linear correlation between [C II] and dust continuum luminosity. Galaxies which have higher continuum and line brightnesses tend to have later Hubble types. This is consistent with the increase in star formation activity with increasing lateness. Accordingly, the [C II]/FIR ratio is found to increase with the current star formation rate (as measured by the H_α equivalent width) in quiescent galaxies till a "plateau" value, typical of gas-rich and starburst galaxies (see Pierini et al. this Conference). Moreover, there is no apparent relation between the [C II] line emission and position in the cluster or HI mass central surface density. However, any relation of the [C II] emission to the diffuse HI component of the ISM cannot be discarded since we lack the information about the distribution of the [C II] emission.